



DIG INTO MINING

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Minimalist Mining

Overview

In this activity, students investigate the impact of mining on the environment. Students conduct research into a specific mineral, such as copper, and categorize the mining methods and their effects. For example, copper may be mined at the surface or from underground mines. Students choose two or three methods that minimize the environmental impact of mining their selected mineral. They research these approaches to characterize how they limit mining impacts.

Grade Band: 6 – 8

Topic: Minimizing environmental impacts of mining

Real World Science Topics

- Natural Resources
- Minerals

Objectives

Students will

- Investigate the impact of mining on the environment
- Compare solutions to the environmental impacts of mining
- Analyze land reclamation approaches

Next Generation Science Standards

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Time Needed: 1-2 hours (depending on extent of students' own research)



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Background Information

How do humans use minerals?

Society today uses vast quantities of minerals. The list of products in our lives that use minerals seems inexhaustible, whether cars, computers, appliances or cell phones. For example, a modern electronic device such as a cell phone uses at least 35 different minerals.

How much do humans rely on minerals?

On average, each American uses 40,000 pounds of minerals every year. Despite this high figure, mining operations have impacted less than a quarter of one percent of the land area of the United States.

How do reclamation efforts reduce the impact of mines on the environment?

In most cases, mining companies undertake measures to limit the long-term effects of mining. Open-pit mines require removing areas of soil above the mineral deposits. Reclamation efforts focus on returning native soils, plants, and animals to support regrowth and biodiversity in the area. Additionally, channels are created to help manage clean surface water. These channels ensure that water impacted by mine waste is kept separate from clean water and reduce erosion of soil and vegetation.

What are other ways land used for mining is protected and restored?

Approaches may include reducing water and energy use, minimizing waste and habitat disturbance. Reclamation is used to re-purpose land for sustainable use, including but not limited to, golf courses, residential areas, wildlife preserves, and gardens.

Key Vocabulary

Reclamation – Returning something to its former state or create an alternative land use

Sustainability – Methods that do not completely destroy or use up natural resources

Procedure

1. **Warm-Up Activity:** Display a series of three images that show the before (exploration), during (construction and production), and after (closure and reclamation) stages of a mining site. Ask students to make observations of each stage by noting what they see changing over time.
2. Describe some benefits of minerals (including several minerals essential for health) and some significant environmental impacts of mining for minerals. Explain to the class that they will investigate environmental impacts of mining and solutions to limit the impacts.

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3. Provide students a list of minerals from which to choose for their research. Provide students a list of minerals to research. Ten common minerals likely to be familiar to students include:
 - Aluminum
 - Chromite (chrome)
 - Copper
 - Gold
 - Halite (sodium chloride/salt)
 - Iron ore
 - Lead
 - Nickel
 - Silica (sand, glass)
 - Silver
4. Guide students to complete the student worksheet based on their research. Encourage students to use quantitative approaches in their investigations and to model their data. For example, students could use Venn diagrams to compare approaches that minimize the environmental impact of mining. They could use concept maps to show the connections between mining, environmental impacts and solutions.
4. **Evaluate:** Invite students to summarize their learning in two sentences using the words reclamation, sustainability, and mining.

Additional Optional Resources

http://files.dnr.state.mn.us/education_safety/education/teachers/activities/soudan_mine/miningfacts.pdf

[http://www.slideshare.net/FirmexVirtualDataRoom/amazing-mining-facts-](http://www.slideshare.net/FirmexVirtualDataRoom/amazing-mining-facts-25285512?ref=http://www.mining.com/web/10-amazing-mining-facts-you-probably-didnt-know)

[25285512?ref=http://www.mining.com/web/10-amazing-mining-facts-you-probably-didnt-know](http://www.mining.com/web/10-amazing-mining-facts-you-probably-didnt-know)

<http://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html>

<http://www.nma.org/index.php/minerals-publications/40-common-minerals-and-their-uses>

<http://www.miningfacts.org/Environment/How-can-mining-become-more-environmentally-sustainable/>



Minimalist Mining Student Worksheet

Topic: Minimizing environmental impacts of mining

In this activity, you will research the potential environmental effects of mining. You will evaluate solutions to your environmental concerns. One solution is to reclaim land when the mine is closed. Reclaimed land can serve many purposes. These uses could include golf courses, residential areas, wildlife preserves, and gardens.

To evaluate the impact of mining and solutions, choose a mineral to research. Use online resources to conduct your research and then complete the questions below.

Which mineral did you choose for your research?

List three benefits of your chosen mineral.

- 1.
- 2.
- 3.

Compare the amount of the mineral mined in the United States with the amount mined elsewhere in the world.

Describe the primary method by which the mineral is mined.

Classify and compare three environmental effects caused by mining the mineral.



Classify and compare three approaches to providing solutions to environmental effects caused by mining the mineral.

Create a model (such as concept map, Venn diagram, etc.) to show the relationship between the environmental effects and the solutions. Make sure to include examples of the reclamation stage in mining.